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AUTHOR Kopsacheilis, Evangelos V.
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ABSTRACT

This paper presents two cases of the use of a World Wide Web-based system designed to support online educational procedures. The system presented, called DVT (Dynamic Virtual Trainer), consists of one or more server machines that store structured educational material in the form of autonomous units that may be accessed, combined, and presented to the user according to user-defined criteria or choices. In order to demonstrate the system, two educational packages (multimedia corpora) were developed. The first package includes educational material on telecommunications technologies. The second package includes educational material on Mount Athos. (MES)

Development of two Multimedia Corpora for Adaptive Web-based Distance Learning

Evangelos V. Kopsacheilis
Emedia EVK Ltd.
Greece
Email: info@emedia.gr

ABSTRACT: The use of web-based applications for accessing structured educational material is one of the most interesting variations of Distance Learning due to its flexibility and its reduced cost. In this paper we present two cases on the usage of a web–based system designed to support on line educational procedures. The presented system, called DVT (Dynamic Virtual Trainer), consists of one or more server machines which store structured educational material in the form of autonomous units which may accessed, combined and presented to the user according to user-defined criteria or choices. In order to demonstrate the system, we developed two educational packages. The first package includes educational material on Telecommunication technologies. The second package includes educational material on Mount Athos.

Introduction

In the context of Distance Learning a critical factor for the success of a specific course is the possibility of the students for accessing interactive educational resources such as animated presentations, multimedia libraries, etc. Students tend to learn more in classes in which they receive computer-based instruction supported by interactive educational information packages (Kuperstein et al. 1999). The design, development and delivery of such educational resources usually require significant effort to be spent by the teacher or the producer of the electronic educational material. In addition, a teacher should have considerable experience in computers and web authoring in order to produce a multimedia course tailored to the specific needs of a class or the needs of a geographically dispersed group of students. The problem of time consuming development of electronic educational resources may be faced through the use of flexible tools for the composition of electronic educational material. Using these kind of tools a teacher could easily create, enrich and maintain a body of electronic educational resources without the need of extended skills on computers and web authoring. As a result, the usage of such flexible tools may promote the introduction of information technologies in the day-to-day teaching practice.

In this paper we present a flexible architecture called DVT which stands for Dynamic Virtual Trainer (Kopsacheilis et al. 1999). We also demonstrate its use in developing two educational packages (multimedia corpora) on different subjects. The proposed architecture allows the dynamic composition of online lessons based on the combination of educational units according to varying user needs. The educational units are short composite entities of a variety of types like modules in HTML (HyperText Markup Language), virtual reality representations in VRML (Virtual Reality Markup Language), text, audio and video clips, etc. (Minoli & Keinath 1994). The dynamic composition of the lessons may be guided either by user defined search criteria or by other types of parameters like the desired level of lesson details, the level of relevance to other topics, etc.

A Flexible Development Platform

DVT is based on one or more servers who store the educational entities. The users are connected to the server through a common Internet browser and they have access to the introductory web pages of the server. The most important feature of these pages is the possibility for tailoring the lesson to be presented through the selection of the focal points of the discussion, the analytical level of the lesson, the levels of accompanying information, etc. The user may select one or more predefined lessons out of a menu. A much

more dynamic possibility is the real time composition of a lesson according to criteria entered by the user. The user may also use a set of questionnaires that accompanying the lesson's elements in order to self evaluate the educational procedure. The questionnaires are highly configurable (simple true-false answers, multiple choices, etc.). In addition a questionnaire may be easily formed to support the user providing tips, summarized information, etc. DVT uses the Internet-Intranet communication technologies for the distribution of the lesson (Halsall 1995). The entire architecture is supported by a DataBase, which keeps the relations between the elements of the educational material. The educational material stored in the server has the form of simple and short packages of information describing a specific topic, which are called Information blocks (IBs). An IB may include HTML pages, VRML representations, text, audio or video clips or a combination of the above components. Each IB corresponds to a set of parameters called Connectivity Block (CB) which supports the dynamic composition of the lessons. These parameters are used by the DVT Data Base in order to combine each IB with other relevant IBs or in order to combine the IB with a questionnaire. Finally the CBs include a set of key words which are used to select the specific IB each time the user enters one of the specific key words. A group of IBs forms a Chapter. A Chapter is focused on a set of relevant topics. A group of Chapters forms a Book. A Book covers a wider group of topics. This structure is depicted in Figure 1.

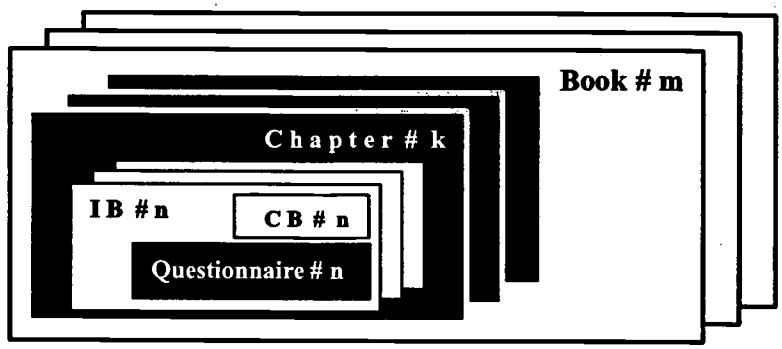

Figure 1. Information Structure in DVT

The overall quality of the produced lessons is a function of two factors: a) the multimedia content of each educational unit and b) the structure of the lesson which is reflected in the relations of the educational units. Courses for distance learning usually include a mix or a combination of various media. The key factors in the choice of media are the course objectives, the intended students and their geographical locations. The flexibility of the proposed system is based on the fact that any type of educational media may be incorporated in a course and presented by the system. The supported media include audio, video, text, images, Virtual Reality representations, etc. The increased flexibility of the system allows the designer of a lesson to customize and tailor the lesson according to specific student needs and, through this customization, to increase the educational effect of the lesson. The user-friendly environment for developing new educational courses is based on tools for easy composition of educational units and questionnaires. In addition the proposed system incorporates tools to setup relations and dependencies between the educational units. Finally, the educational material produced in the framework of a lesson is reusable in the sense that a number of autonomous units may be used for other courses. This is accomplished through the definition of a new relation of the educational unit in the framework of a new lesson. Based on this feature, a Virtual Reality representation of an ancient temple may be used in a course on architecture as well as in a course on ancient history, or even in a course on geometry. The proposed architecture supports the dynamic composition of related and mutually depended educational entities. The overall effect of the produced lessons depends on two major factors:

a) The structure and quality of each educational unit, and;
b) The overall course design, which is depicted in the relations between the educational units.

The proposed system allows the distribution of the dynamic educational material through low cost Internet based infrastructures. The DVT architecture is open and allows the integration of supporting

applications like real time video or voice conferencing packages. The educational resources provided to the students may be considered as a powerful complement of teleconferencing. DVT may be implemented on low cost hardware, software and communications platforms.

It is important to emphasize that the proposed system is not a specific implementation of an online course. It should be considered as a generic development platform, which allows the creation of interactive lessons on many different topics from different areas. More precisely, the proposed system allows the educator to create electronic educational libraries of short and autonomous entities, and to compose their contents to complete lessons or courses.

Using DVT for the Development of Educational Corpora

The above-described DVT architecture was used for the development of two educational packages on Telecommunications and Mount Athos respectively. We use the term Multimedia Corpora for the above educational packages in order to emphasize that they are complete educational entities made from multimedia educational material. Mount Athos is a peninsula in northern Greece. Twenty Monasteries are located on Athos since the medieval age (10th century) forming a unique monastic state. This package presents the history, the medieval artifacts, the natural environment and flora and fauna of Mount Athos.

The topic of telecommunications is presented mainly by means of text and animated graphics. The text modules include definitions and descriptions and the animated graphics are used mainly to accompany and support the descriptions. This package also includes a number of exercises and multiple choice questionnaires for self-evaluation of the users. The subject of Mount Athos is presented mainly by text, photographs, audio and video clips. Both corpora include educational information covering a variety of subjects. In Table 1 we summarize the presented topics.

Telecommunication Technologies	• Basic Definitions	• Transmission Technologies	• Examples of applications
	• Examples of complete systems	• Perspectives	• Future applications
	• Exercises		
Mount Athos	• History	• Architecture	• Geography of Mount Athos
	• Medieval Artifacts	• Byzantine Art (icons and music)	• Religious Art of 19th century
	• Natural Environment	• Flora and Fauna	

Table 1. Summary of Subjects Covered per Educational Package

The two corpora are presented to the users over Internet connections using the DVT dynamic page composition system. The composition is performed on the basis of user-defined choices. Examples of choices are the level of details, the focal point of the discussion (i.e. Geography vs. the History of a region), the level of difficulty, the level of correlation with relevant subjects, etc. Figure 2 depicts a screenshot of the educational package on Telecommunications. Figure 3 illustrates a screenshot from the package on Mount Athos.

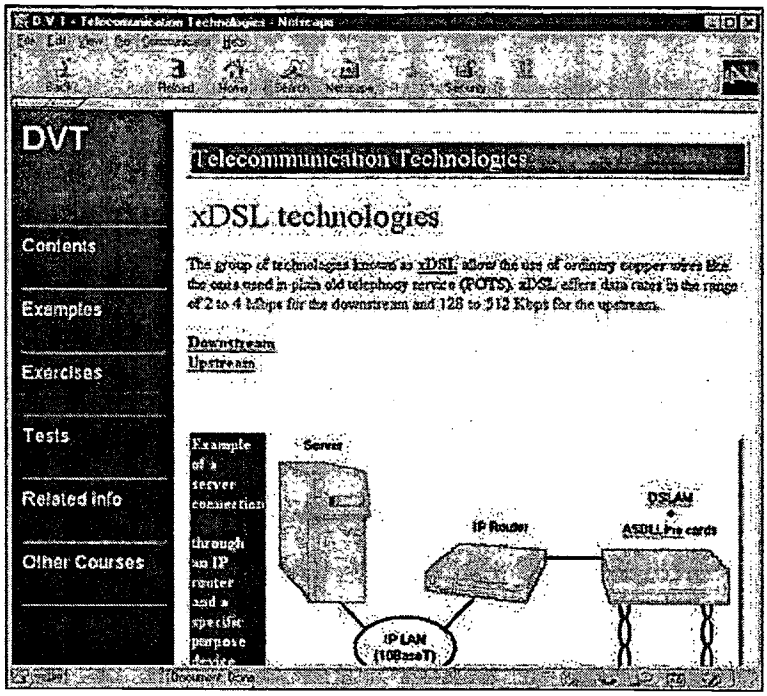

Figure 2. Screenshot of a dynamically composed page on Telecommunications Technologies

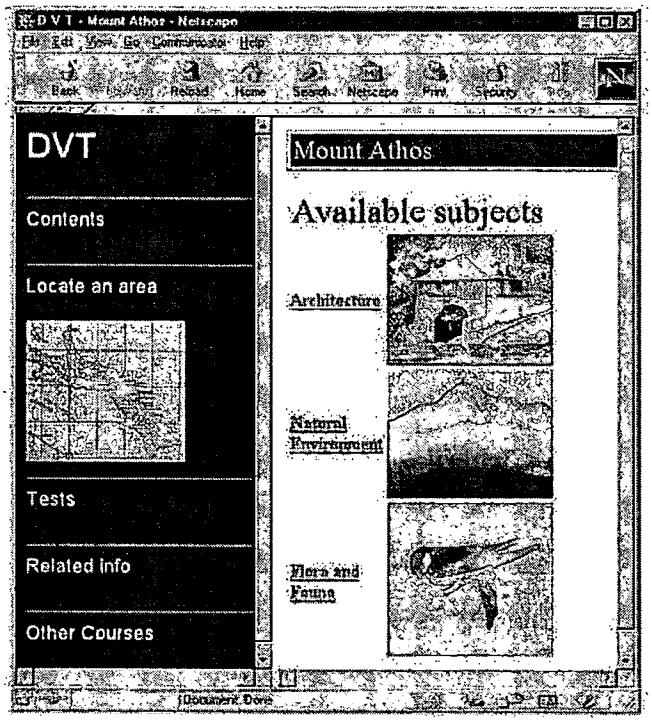

Figure 3. Screenshot of an introductory page on Mount Athos

Conclusions

The paper presents two educational packages developed using the DVT platform. Due to the flexibility of its architecture, DVT may support the development of electronic educational packages on a variety of subjects. The two packages cover Telecommunications and Mount Athos which represent two totally different topics. The DVT architecture has the advantages of flexibility, low cost and ease in developing new educational material and new courses. The advantage of low cost relies on the fact that only an Internet connection is required in order to access the educational material. Of course, the cost of the connection depends on the data transfer rate. In order to achieve satisfactory interactive access to multimedia educational information, a data rate in the range of 128 kilobits per second (or higher) is required. The feature of flexibility relies on the fact that the system demonstrates satisfactory and adaptive performance on different educational applications, over connections that vary in speed as well as for different computer platforms and operational systems. In addition the modules of educational information used to setup a lesson may have different styles and types. The modules are composite entities of a variety of types like HTML modules, VRML representations of virtual environments, audio and video clips, Java simulations, etc. The proposed architecture allows the designer of a course to select any component of any type. It also allows the designer to establish any relation between the components and finally to create a corpus of educational material which may fulfil a variety of pedagogical targets. The ease in developing new educational material relies on the fact that the educational information is stored in the server(s) in the form of short and autonomous modules, which are combined to setup a lesson. It is important to emphasize that the system acts as a powerful tool for the educators. The performance of the on-line lessons produced by the system, depends both on the relations between the information modules stored in the data base, as well as on the content and appearance of each information module. This implies that the system allows the tutor to incorporate his/hers experience into the educational resources to be developed.

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